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Effect of soilless growing media compositions on quality flower production of potted Chrysanthemum (*Chrysanthemum morifolium)*

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ABSTRACT

The suitability of soilless growing media compositions was evaluated for quality flower production of potted Chrysanthemum morifolium Ramat cultivar Anmol at Punjab Agricultural University, Ludhiana during 2014-16. The rotted cuttings were grown in six different potted media compositions – control: garden soil + (farmyard manure (FYM) 2: 1), cocopeat + FYM (1: 1), cocopeat + FYM (2: 1), vermiculite + FYM (1: 1), vermiculite + FYM (2: 1) and cocopeat + vermiculite + FYM (1: 1: 1). The results revealed that the cocopeat + FYM (2:1) exhibited maximum plant height, number of leaves and root suckers per plant whereas; vermiculite + FYM (2:1) gave highest flower diameter and duration of flowering. The days to bud appearance, colour break stage and full bloom were delayed in cocopeat based media. However, significant vegetative growth with better flowering time and quality was obtained in cocopeat + vermiculite t + FYM (1:1:1). Thus for sustained quality flower production of potted Chrysanthemum cv. Anmol, cocopeat + vermiculite + FYM (1:1:1) media was ideal with better plant morphological development.

Keywords: Chrysanthemum, cocopeat, flower production, growing media, pot media

INTRODUCTION

With increased demand of potted ornamentals, the need for a light weight soilless growing medium has become more desirable due to their easy mobility and display during exhibitions and flower shows (Dubey *et al.* 2012). The various soilless media i.e. cocopeat, farmyard manure, vermicompost etc. altered the physico-chemical characteristics of the growing mixtures and affect the plant growth, nutritional status (Beckmann-Cavalcante *et al.* 2009) and value of potted ornamental (Vendrame *et al.* 2005). Synthetic aggregates (SA) were also developed as alternative potting media for ornamental plant production (Jayasinghe 2012). The aeration and water retention status of growing media were essential to maintain equilibrium between moisture content and gaseous exchange as well as for maintaining keeping quality of chrysanthemum in a limited volume of a pot (Kukal *et al.* 2012). Therefore, it becomes pertinent to formulate a soilless growing mixtures amended with optimum proportions of media for growing plants in limited volume of containers. Cocopeat had been used as a light weight media constituent to raise ornamental potted plants of acceptable quality (Jeyaseeli and Raj 2010; Duggan-Jones *et al.* 2013). Vermiculite, a hydrated laminar magnesium-aluminium-iron-silicate ((Mg, Fe, Al) 3((Al, Si) $4O_{10}$) (OH) $2.4H_2O$), an expandable 2:1 mineral, often formed from alteration of mica had been widely available (Aristov *et al.* 2000), easy to handle, odourless, and low-cost material (Duman and Tunc 2008). Farmyard manure are major source of nutrient supply and considered a desirable soil amendment and report of its effect on soil properties are numerous. The chemical characteristics and nutritional status of the media mixture played crucial role in the plant development as these determine nutrient and water availability to plants (Dewayne *et al.* 2003). For maintaining the keeping quality of ornamental plants especially chrysanthemum, the ability of media to maintain balance between gaseous exchange and water content is necessary. Therefore, the effect of different soilless growing media on flower quality production of Chrysanthemum cv. Anmol was studied and light weight growing media with desirable physio chemical properties for flower production was analyzed.

MATERIALS AND METHODS

The present study was carried out at Department of Floriculture and Landscaping,

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Punjab Agricultural University; Ludhiana for two years during 2015-16. The terminal cuttings (5-7 cm) were taken from the mother stock plants) pinched in end of May were planted in burnt rice husk/sand for rooting in June-July and transplanted individually in July-August in the earthen pots (6 inch) filled with growing media compositions as per the treatment- control: (Garden soil + FYM (2:1)), cocopeat + FYM (1:1), cocopeat + FYM (2:1), vermiculite + FYM (1:1), vermiculite + FYM (2:1), cocopeat + vermiculite+ FYM (1:1:1). The experiment was laid out in completely randomized design (CRD) with three replications comprising five pots per replication. The vegetative parameters at 45, 60, 75 and 90 days after planting (DAP), floral parameters and physico-chemical properties of media were recorded for two years and analyzed statistically using SAS software. The treatment means were compared using Duncan Multiple Range Test (DMRT) at 5% level of significance (Duncan 1955).

Post-harvest media analysis: The growing media samples were used for determination of pH, electrical conductivity (1:2 media: water suspension), maximum water-holding capacity, bulk density and total nitrogen by adopting standard procedures.

RESULTS AND DISCUSSION

Vegetative parameters: In *Chrysanthemum morifolium* cv. Anmol, the media compositions significantly ($p<0.05$) influenced the plant height and number of leaves at 45, 60, 75 and 90 days after planting (DAP) and root suckers per plant (Table 1). The plant height at 45 DAP was maximum (15.1 cm) in cocopeat + FYM (2:1) followed by (14.9 cm) cocopeat + FYM (1:1) and minimum in control (12.4 cm). The plant height at 60 DAP was significantly better (25.0 cm) in cocopeat + FYM (2:1) followed by (23.9 cm) cocopeat + FYM (1:1) and minimum (14.4 cm) in control. The plant height at 75 DAP was maximum (37.0 cm) in cocopeat + FYM (2:1) followed by (36.1 cm) cocopeat + vermiculite + FYM (1:1:1). The plant heights at 90 DAP was maximum (41.8 cm) in cocopeat + FYM (2:1) followed by (41.1 cm) cocopeat + FYM (1:1) and minimum in control (31.3 cm). The number of leaves per plant at 45 and 60 DAP were significantly better (35.2 and 52.1) in cocopeat + FYM (2:1) followed by (33.4 and 51.0) cocopeat + FYM (1:1) and minimum (25.5 and 31.7) in the control. The number of leaves at 75 and 90 DAP were maximum (62.5 and 65.2) in cocopeat + FYM (2:1) followed by (62.1 and 64.5). The number of root suckers per plant were significantly better (12.4) in cocopeat + FYM (2:1) followed by (12.0) cocopeat + FYM (1:1). The superiority of cocopeat containing media compositions *w.r.t.* vegetative growth could be due to physio-chemical characteristics including lower bulk density, higher total porosity, water holding capacity and nitrogen availability to the plants (Awang *et al.* 2009). The present results could be correlated as reported by Khayyat *et al.* (2007) indicating the superiority of cocopeat over other pot mixtures on pothos. The highest values of leaf number, and shoot length in pothos were observed in medium contained cocopeat only (Sameei *et al.* 2004).

Table 1: Effect of soilless growing media composition on plant height, number of leaves and root suckers per plant of *Chrysanthemum morifolium* cv. Anmol

Treatments	Plant height (cm)				Number of leaves per plant				No. of root suckers per plant
	45 DAP	60 DAP	75 DAP	90 DAP	45 DAP	60 DAP	75 DAP	90 DAP	
Garden Soil + FYM (2:1)	12.4 d	14.4 d	19.5 c	31.3 d	25.5 c	31.7 d	49.5 c	56.9 c	9.4 c
Cocopeat + FYM (1:1)	14.9 a	23.9 ab	36.0 a	41.1 a	33.4 ab	51.0 ab	62.1 a	64.5 a	12.0 ab
Cocopeat + FYM (2:1)	15.1 a	25.0 a	37.0 a	41.8 a	35.2 a	52.1 a	62.5 a	65.2 a	12.4 a
Vermiculite + FYM (1:1)	13.2 bc	21.9 c	32.2 b	36.0 c	31.8 bc	49.7 abc	57.6 b	59.6 b	11.2 abc
Vermiculite + FYM (2:1)	13.0 c	20.2 d	30.9 c	35.7 c	33.2 abc	48.8 bc	56.8 b	59.0 b	10.7 bc
Cocopeat + Vermiculite + FYM (1:1:1)	14.3 ab	23.2 bc	36.1 a	39.8 b	34.0 ab	51.4 a	61.2 a	64.3 a	12.0 ab
F- test	*	*	*	*	*	*	*	*	*

Flowering time and flower quality: The media compositions significantly ($p<0.05$) influenced days to bud appearance, colour break stage and full bloom (Table 2). The days to flower bud appearance, colour break stage and full bloom were significantly more (99.2, 131.7 and 144.9 days, respectively) in cocopeat + FYM (2:1) followed by 97.9, 131.5 and 143.6 days, respectively in cocopeat + FYM (1:1). The minimum days to flower bud appearance, colour break stage and full bloom were obtained in the control (91.8, 119.3 and 135.5 days, respectively). The flower bud appearance and time taken to full bloom were delayed with cocopeat based media which could be due to higher availability of nitrogen in these media combinations, which encouraged the vegetative growth and delayed flowering. These results support the findings of Thakur *et al.* (2018).

Table 2: Effect of soilless growing media compositions on flowering time and flower quality of *Chrysanthemum morifolium* cv. Anmol

Treatments	Days to flower bud appearance	Days to colour break stage	Days to full bloom	Number of flowers per plant	Flower diameter (cm)	Duration of flowering (days)	N content (%)
Garden Soil + FYM (2:1)	91.8 d	119.3 d	135.5 d	50.5 c	3.3 d	15.0 c	0.8 f
Cocopeat + FYM (1:1)	97.9 ab	131.5 ab	143.6 ab	70.9 a	5.0 c	14.9 d	1.4 b
Cocopeat + FYM (2:1)	99.2 a	131.7 a	144.9 a	71.5 a	5.3 bc	16.3 bc	1.6 a
Vermiculite + FYM (1:1)	94.9 c	128.8 bc	138.2 cd	68.6 b	6.4 a	17.2 ab	1.0 d
Vermiculite + FYM (2:1)	94.7 c	127.4 cd	137.6 d	68.1 b	6.2 a	18.1 a	0.9 e
Cocopeat + Vermiculite + FYM (1:1:1)	96.9 bc	129.9 abc	141.0 bc	69.9 ab	5.7 b	16.2 c	1.2 c
F- test	*	*	*	*	*	*	*

The flower quality parameters including duration of flowering and flower diameter were better in vermiculite amended media, while, number of flowers and nitrogen content were more in media containing cocopeat (Table 2). The duration of flowering was significantly better (18.1 days) in vermiculite + FYM (2:1) followed by 17.2 days in vermiculite + FYM (1:1). The number of flowers per plant and nitrogen content in plants were maximum (71.5 and 1.6 %) in cocopeat + FYM (2:1) followed by (70.9) cocopeat + FYM (1:1). The flower diameter was maximum (6.4 cm) in vermiculite + FYM (1:1) followed by (6.2 cm) vermiculite + FYM (2:1). The duration of flowering and flower diameter were maximum in vermiculite amended media which might be due to higher availability of potassium in this media mixture. The higher number of flowers per plant and nitrogen content in the media containing cocopeat are supported with the findings of Nair and Bharathi (2015).

Table 3: Post-harvest analysis of med

Treatments (media composition)	pH	EC (dS m^{-1})	BD (Mg cm^{-3})	WHC (%)	Total N (%)	P (%)	K (%)
Garden Soil + FYM (2:1)	7.79	0.246	1.10	30.16	0.20	0.82	2.12
Cocopeat + FYM (1:1)	7.41	0.639	0.21	245.66	1.31	1.23	2.07
Cocopeat + FYM (2:1)	7.60	0.484	0.16	338.28	1.48	0.89	2.25
Vermiculite + FYM (1:1)	7.58	0.282	0.48	140.21	0.44	1.61	3.39
Vermiculite + FYM (2:1)	7.79	0.483	0.44	95.32	0.28	2.07	3.77
Cocopeat + Vermiculite + FYM (1:1:1)	7.61	0.473	0.31	207.78	1.29	1.89	2.92
F-test	ns	*	*	*	*	0.82	2.12
C.D. (p=0.05)	ns	0.11	0.17	5.72	0.12	0.13	0.11

Post-harvest media analysis: The treatment comprising cocopeat + FYM (2:1) recorded the highest WHC (338.2%), whereas highest value of bulk density (1.10 Mg m^3) was recorded in soil + FYM (2:1) (Table 3). The maximum value (1.4 %) of total nitrogen was obtained in cocopeat +

FYM (2:1), whereas, maximum phosphorus (2.0 %) and potassium (3.7 %) was recorded in vermiculite + FYM (2:1). The minimum phosphorus (0.8 %) and potassium (2.0 %) was recorded in soil + FYM (2:1) and cocopeat + FYM (1:1). The results showed better plant growth in cocopeat based medium might be due to the higher water holding capacity, aeration and organic matter of the cocopeat (Nair and Bharathi 2015). Analysis of the potting media showed that all the combinations had sufficient amount of nutrients essential for plant growth except the soil + FYM (2:1). Being fibrous, the cocopeat fiber evenly spreads in the soil, and because of its light weight it reduces the bulk density with simultaneous increment in total porosity, which affects the WHC (Awang *et al.* 2009).

It may be concluded from the results that for sustained quality flower production of potted Chrysanthemum cv. Anmol, cocopeat + vermiculite + FYM (1:1:1) media was ideal with better plant morphological development.

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